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Invited Commentary

Invited Commentary: Use of Epidemiologic Methods to Guide Comprehensive and Equitable Approaches to Policy

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Despite a dramatic reduction in the prevalence of commercial cigarette smoking in the United States, children are still commonly exposed to secondhand smoke (SHS), which is a cause of various pediatric health problems. Further, SHS exposure is patterned by race and class, exacting an inequitable toll on children from families with lesser social and economic advantage. In this issue of the *Journal*, Titus et al. (*Am J Epidemiol*. 2023;192(1):25–33) use natural experiment evaluation methods (difference-in-differences) to test whether the recently implemented US Department of Housing and Urban Development policy that forbade smoking in and around New York City Housing Authority buildings affected child respiratory health. The results from their work remind us that policies do not always impact outcomes as we might expect. Given that policy is one of the most potent tools for population health promotion, this work underlines the need for epidemiologists to engage in policy evaluation at all stages of the policy life cycle, in order to discover comprehensive approaches to policy development and implementation that prioritize equity and address structural racism.

housing; low-income populations; natural experiments; policy evaluation; secondhand smoke; social epidemiology

Abbreviations: HUD, US Department of Housing and Urban Development; NYCHA, New York City Housing Authority; $PM_{2.5}$, particulate matter less than or equal to 2.5 μm in aerodynamic diameter; SHS, secondhand smoke.

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Secondhand smoke (SHS) is broadly harmful to the health and well-being of children and is particularly detrimental to their respiratory health (1, 2). With the dramatic reduction in adult smoking prevalence in the past 20 years, there has been a parallel and precipitous drop in the proportion of young children exposed to SHS. In the 1999–2000 National Health and Nutrition Examination Survey, 64.5% of US children aged 3–11 years had biomarker levels consistent with SHS exposure; by 2013–2014, SHS exposure prevalence had fallen to 38.1% of this age group (3). Despite a period of rapid improvement, the prevalence of SHS exposure among children in the United States has stabilized and remains unacceptably high (4).

SHS exposure is patterned by race and class, exacting an inequitable toll. Children who live in households that face greater social and economic disadvantage in US society, including Black children and those living in poverty, are by far the most likely to be exposed (3). The causes of these disparities in SHS exposure have a multidimensional nature, relating to individual behaviors, environmental contexts, commercial pressures, accumulated historical marginalization, and, perhaps most profoundly, who in our society benefits from protections that are put into place via policies.

Policies that promote smoke-free indoor air in workplaces have been a major driver reducing the prevalence of smoking and exposure to smoke. However, for children, the home is a prime venue of exposure. In multiunit residential buildings, homes share walls, hallways, common spaces, and/or stairwells with other homes. Compared with single-family homes, the likelihood of SHS exposure for residents

in multiunit buildings is greater, in part because multiunit buildings can contain a relatively high proportion of residents who smoke (5); but even the residents of units where no one smokes are still often exposed, as smoke migrates between spaces (6). To address this, there has been a recent proliferation of smoke-free policies that target residential buildings, yet there remain unanswered questions about their effectiveness (7).

CAN POLICY PROTECT CHILDREN FROM SHS EXPOSURE?

In a study described in this issue of the *Journal*, Titus et al. (8) aimed to test whether policies that forbid smoking in multiunit housing buildings can have an impact upon child health. In 2016, the US Department of Housing and Urban Development (HUD) issued a rule requiring that all public housing agencies (local agencies that receive HUD funds to provide housing at subsidized rates to lower-income people, people with disabilities, and the elderly) disallow smoking in all areas of their buildings' indoor spaces, as well as outdoor spaces that are within 25 feet (7.6 m) of the buildings (9). New York City Housing Authority (NYCHA) buildings were to be governed by the new federal policy, starting on July 30, 2018, while private-sector buildings that provided subsidized housing through the "Section 8" voucher program would not be subject to the HUD rule. Titus et al. used Medicaid claims, with children's addresses linked to borough-block-lot parcels (which indicated what building a child resided in), to compare outcomes related to children's respiratory health in NYCHA buildings with the respiratory health outcomes of children who lived in Section 8 housing, before and after the policy's enactment.

The authors' findings ran counter to the expectation that the HUD policy would cause there to be relatively fewer pediatric respiratory issues. While outpatient and emergency department visits declined for both children living in NYCHA buildings and children living in comparison buildings, the decline for children in NYCHA buildings, which were subject to the HUD policy, was somewhat lesser than that in the comparison group. However, despite their findings' being counterintuitive, they align with this research team's earlier study results, which found that the HUD policy did not appear to affect ambient levels of nicotine or particulate matter less than or equal to 2.5 μm in aerodynamic diameter ($PM_{2.5}$) in stairwells or apartments of smokers in NYCHA buildings relative to buildings with Section 8 apartments (10).

HOW COULD THIS BE?

It can be at best challenging and at worst inappropriate to piece together a post hoc narrative that purports to explain what transpired to cause the opposite of what you expected. Even the most straightforward-seeming policy that should operate in an obvious manner, like one that forbids smoking indoors, may not have its intended effect in practice. A policy simply might not "work" at all, or alternately it could be that the policy is effective in some contexts but not others. Here, both possibilities deserve examination.

Nicotine is a highly addictive substance, and it is incredibly challenging for smokers to give up the habit. The HUD policy, which did not provide residents with cessation aids, prohibited smoking in all indoor spaces, and curtailed easy access to outdoor smoking (due to the 25-feet restriction), may have left those smokers few spaces other than their own apartment units where they felt they could smoke without reprimand. If smokers still smoke in their homes after a smoke-free building policy is adopted, and perhaps even more than prepolicy, SHS levels may persist or even increase in buildings. Previously it had been reported that the density of neighborhoods with NYCHA buildings, in addition to weather concerns and poorly maintained facilities (i.e., broken elevators), made finding an outdoor space more than 25 feet (7.6 m) away from the building in which to smoke a challenge (11). Qualitative work has revealed that smokers report that if smoking is banned in common areas, they will smoke in their units, where smoking is easier for them to conceal (12) and harder for building managers to enforce (13). This response and its consequences may not be exclusive to cities as dense or cold as New York. Research on implementation of the HUD policy in Norfolk, Virginia, found that despite an initial reduction in $PM_{2.5}$ levels immediately after policy implementation, 1 year after the policy was adopted measured $PM_{2.5}$ levels were higher than prepolicy (14).

The effectiveness of smoke-free policies in multiunit housing will certainly vary by context. Earlier research indicated that adoption of smoke-free policies was associated with residents' reporting fewer smoke incursions into their units in market-rate buildings but not subsidized buildings (15). Here, epidemiology can contribute to understanding what policies work and where; but other methods, such as qualitative research (as mentioned above) and community-engaged discovery, can be better equipped to discern why policies do or do not work. These streams of knowledge are critical for policy refinement and optimization. For the most part, the people who make the policies for public housing authorities are not smokers and do not live in public housing authority buildings. As such, they are often not personally familiar with the around-the-clock pragmatics of having a home in a public housing authority building. Not incorporating residents' perspectives, as well as the perspectives of those who will be charged with enforcement, into either the policy or its evaluation has constrained success in this policy space (7).

A final possible explanation for the unanticipated findings is that they could be spurious and could stem from shortcomings in the study's validity. Evaluating policies via a natural experiment at hand has inherent challenges, including teasing out effects of the policy under examination from the effects of other policies, events, or secular trends. The credibility of the findings presented here is bolstered not just by their concordance with some (10, 14) (though not all (16, 17)) prior work but also by the robust approach Titus et al. used. Employing difference-in-differences methods can distill the focal policy's effect from the effects of other policies or any sort of shared exposures or trends that persons under the policy and comparison conditions both experience. However, the validity of a difference-in-differences analysis

relies on there being no violations of the "parallel trends" assumption (18). The authors meticulously addressed at least a portion of these concerns, related to families in the 2 types of buildings having differential Medicaid enrollment patterns, via a series of sensitivity analyses. Additionally, use of the negative control outcome of injury-related visits and a placebo year (2017–2018, prior to policy implementation) was a further check for the main results' being driven by residual confounding. The supplemental analyses revealed a remarkably consistent story, contributing credence to the idea that the main findings were not an artifact of error. A final issue is that there could have been some misclassification of exposure due to the possibility that some Section 8 (comparison) buildings could have instituted a policy similar to HUD's in the same time frame, which would have diluted any effects observed in this study.

A NEED FOR EPIDEMIOLOGY THROUGHOUT THE POLICY LIFE CYCLE

Evidence is useful during all phases of sound prevention policy development and implementation. However, epidemiology is often primarily focused upon the primordial prepolicy work of assessing public health threats and aiming to discover exposures that play a causal role. These prepolicy phase questions seem more straightforward to validly assess through traditional epidemiologic techniques and study designs. However, rigorous evaluation that uses an epidemiologic tool kit is critical throughout the "policy life cycle" in order to most effectively employ policy as a population health tool. This life cycle begins when a candidate policy approach is identified and developed and has its efficacy tested. After there is widespread adoption of the policy, monitoring may need to continue. It is important to ensure that the policy is operating equitably and that benefits are not exclusive to select segments of the population, and unintended consequences need to be identified (19). In certain situations, to correct inequities, the benefits of the policy may need to be redirected toward groups that have been or are subject to injustice. This ongoing surveillance is important, because the world is not a static place. For instance, shifts that might have been hard to foresee in the recent past when smoke-free residential policies were written, such as the introduction of novel nicotine delivery devices to the market, recreational marijuana legalization, etc., could alter how well smoke-free policies operate and even dilute their effects. Quantifying the impact of policies that have targeted various populations and at different times and places with variable fidelity and enforcement, none of which the epidemiologist can control, is a messy business and can be complicated; but it is worthwhile for epidemiologists to engage in tackling these challenges.

VALUING EQUITY IN OUR POLICIES

Determining what works is the province of science, but decisions about what polices to pursue, ways to develop and implement them, and how to gauge their success is a reflection of society's values (20). Policy failures can often be traced to both a misalignment of priorities among players and a restricted perspective on larger contexts. One structural force that has rightfully received greater attention in the public health literature in recent years is structural racism (21, 22). In epidemiologic research there has been recent interest in measuring structural racism (23), with the goal of being able to more effectively tackle the fundamental causes of population health inequities. This endeavor goes hand in hand with policy evaluation, as policy is a major expression and tool of structural racism or antiracism. The measures of structural racism that have been developed recently often use a latent variable approach, creating a measure of the construct comprised of various outcomes of racist processes, like residential racial segregation (23–26). An ancillary approach to enumerating the intensity of structural racism is to measure the racist and antiracist policies that cause the inequitable outcomes (27, 28). An example in the arena of commercial tobacco control would be local policies that forbid all tobacco flavorings but exclude menthol. Excluding menthol from a policy that bans flavored tobacco is a racially inequitable policy, as menthol tobacco is most commonly used by Black smokers and has been implicated in the disproportionate burden of tobacco-related disease among Black Americans (29). Even policies that are not obviously written or implemented in a way that calls out race or racism will have qualities that can either reinforce or ameliorate racial inequities. In fact, antiracist policy has been defined as "any measure that produces or sustains racial equity between groups" (30, p. 322). In a society that values antiracism, policies' contribution to the continuation of structural racism needs to be assessed and remedied.

WHAT THIS MEANS FOR PUBLIC HEALTH POLICY EVALUATION

Tobacco smoke in the air may not feel like an urgent research topic or policy issue, because SHS has all but disappeared from the indoor spaces inhabited by the professional classes who steer both research and policy agendas. It is not an accident that commercial tobacco control policies have worked very well to clear the air in the workplaces and homes of the middle, upper middle, and professional classes (31). Other authors have recently noted specific approaches that can be used to incorporate an equity lens in tobacco policy (32); however, these issues are neither idiosyncratic nor specific to tobacco. For instance, a similar deprioritization is currently transpiring with regard to coronavirus disease 2019 (COVID-19) policy. Control of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission has many parallels to commercial tobacco control, including the reality that indoor air can be dangerous when there is no mitigation, that one's own behavior can affect the health of many other people, and that there is forceful pushback against protections from those who are certain that these public health policies would harm economic interests. Lamentably, observing what happened with commercial tobacco can bring on a feeling of déjà vu, as US leaders' motivation to develop, refine, enact, evaluate, and support policies that would reduce coronavirus transmission

diminished once persons with greater privilege had obtained reasonable protection.

The solution is a commitment in our field to truly valuing and prioritizing population health that does not leave behind those who have been socially marginalized due to structural forces. For this, epidemiologists must engage in rigorous evaluations throughout the policy life cycle, prioritizing antiracism and equity for marginalized groups as important systematically measured outcomes. This may involve a shift in mindset for many epidemiologists, to extend our work beyond where we may have been taught (in training) that it ends and truly open our field to perspectives that have been less commonly represented. The bar needs to be raised—our work is neither "good enough" nor done when marginalized groups continue to be left out of benefits that those with privilege reap from our work.

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